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NOISETTE CREEK HYDROGRAPHICAL STUDY INTERIM REPORT CNC CHARLESTON SC
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ENVIRONMENTAL CONSULTING AND TECHNOLOGY, INC.

NOISETTE CREEK
HYDROGRAPHICAL STUDY
INTERIM REPORT

Prepared for:

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ECT NO. 001017-0100

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1.0 INTRODUCTION

Noisette Creek is a small tidal tributary of the Cooper River near North Charleston, South Carolina. The navigable mainstem of the creek is about 1.4 miles from the mouth of the creek to approximately 1,000 feet (ft) west of the South Rhett Avenue (see Figure 1). The narrow, non-navigable upstream part of the creek is about 0.4 miles. A segment downstream of the creek, about 0.5 mile, near the mouth, runs through Charleston Naval Complex (CNC) along the boundary between Zone A and Zone B of the complex. Eight storm water outfalls drain into Noisette Creek from CNC.

A hydrographical study was conducted for Noisette Creek on December 6 and 7, 2000. The purpose of the study was to gather information to assess the potential impacts of the CNC outfalls on Noisette Creek.

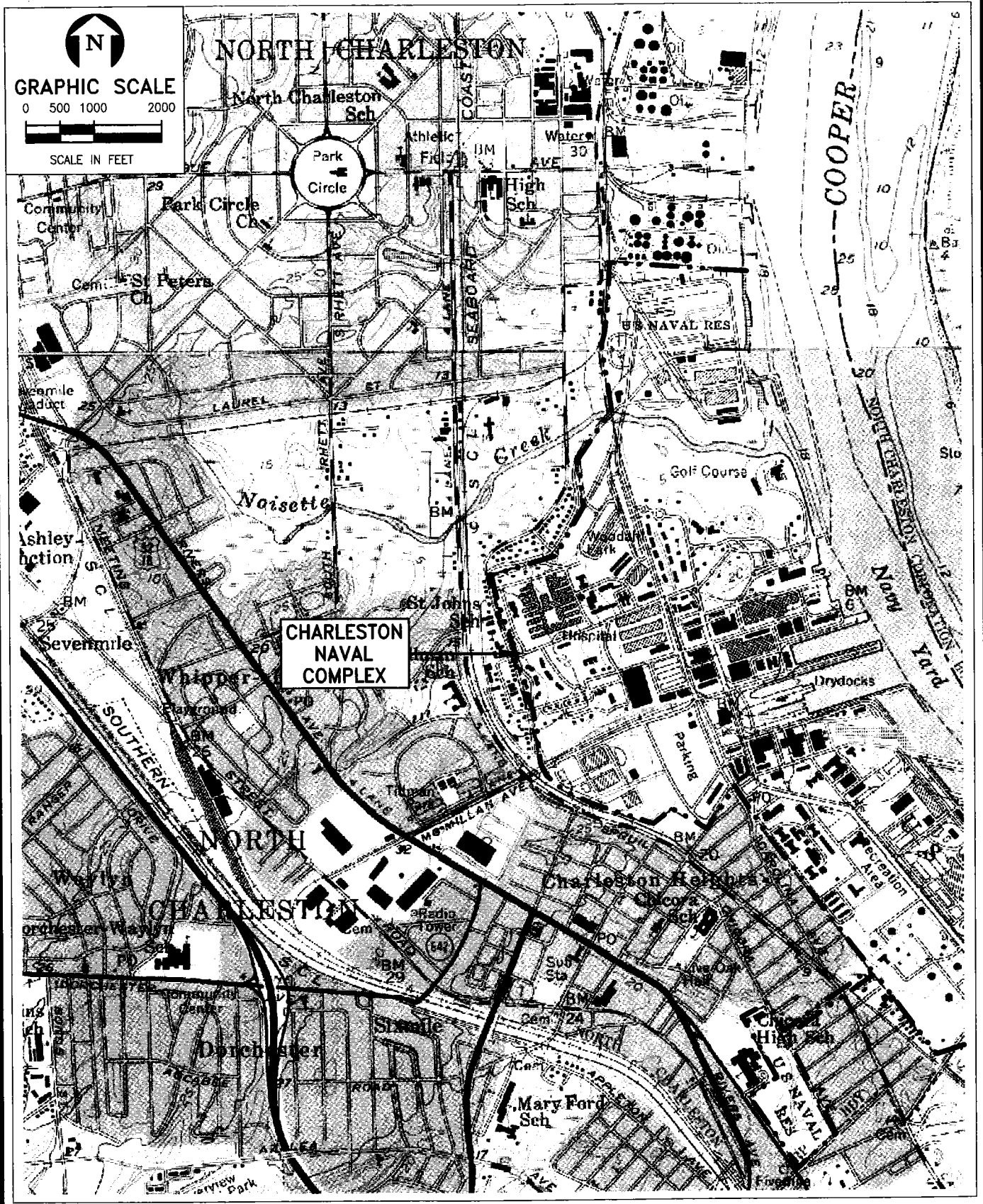

FIGURE 1.

NOISETTE CREEK LOCATION MAP

Source: USGS Quad: Charleston & North Charleston, SC, 1979; 1979; ECT, 2001.

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2.0 SITE DESCRIPTION

The total drainage area of the Noisette Creek is approximately 1,458 acres, of which 231 acres is within the CNC boundary. One-half mile of the creek runs through an abandoned golf course in CNC near the creek mouth. There are two bridges crossing the Noisette Creek within CNC: a bridge at Hobson Avenue near the western boundary of CNC and a railroad bridge parallel to Hobson Avenue. Three offsite bridges for motor vehicles also cross the mainstem of the creek. The bridges are located at O'Hear Road, Spruil Avenue, and South Rhett Avenue. There is a railroad bridge east of Spruil Avenue. The width of the mainstem Noisette Creek ranges from 50 ft at South Rhett Avenue to 110 ft in the downstream segment. The depth of the creek ranges from 0.5 ft to 5 ft below mean low water.

According to National Oceanic and Atmospheric Administration's (NOAA's) tidal table, the average tide range in the Cooper River near the south entrance of the Clouter Creek is about 5.4 ft. The average maximum flood current speed in Cooper River at North Charleston is about 1.1 knots, and the average maximum ebb tidal current in the Cooper River is about 1.7 knots. The total tidal prism of Noisette Creek, or the volume of water between high tide and low tide, is estimated to be 384 acre feet (acre-ft). The average tidal flow is calculated to be 770 cubic feet per second (cfs), and the peak tidal flow is about 1,220 cfs at the creek mouth, assuming the marsh elevation is 2 ft below mean high water.

3.0 HYDROGRAPHICAL DATA

Specific conductivity, salinity, dissolved oxygen (DO), pH, water temperature, and current data were collected at five locations in Noisette Creek on December 6 and 7. The sampling locations were:

- Station 1—Mouth of Noisette Creek.
- Station 2—Hodson Avenue.
- Station 3—O'Hear Road.
- Station 4—Spruil Avenue.
- Station 5—South Rhett Avenue.

Data were also collected in the Cooper River at Marker R54 near Noisette Creek as a reference. Sampling station locations are shown in Figure 2. A YSI multi-parameter water quality sampling equipment and a Marsh McBirney current meter were used to collect data. Sediments were collected by a ponar for visual examination.

The tide ranges near the study area varied from 4.1 to 4.7 ft during the study period (see Figure 3). NOAA's tidal prediction at the Cooper River near the Clouter Creek South entrance for the month of December 2000 (see Figure 4) indicates that the hydrographical study was conducted near a neap tide when the tide range was close to minimum for the month. The widths of the Noisette Creek measured at low tide at various locations are shown as follows:

Station	Width (ft)
2	108
3	112
4	92
5	51

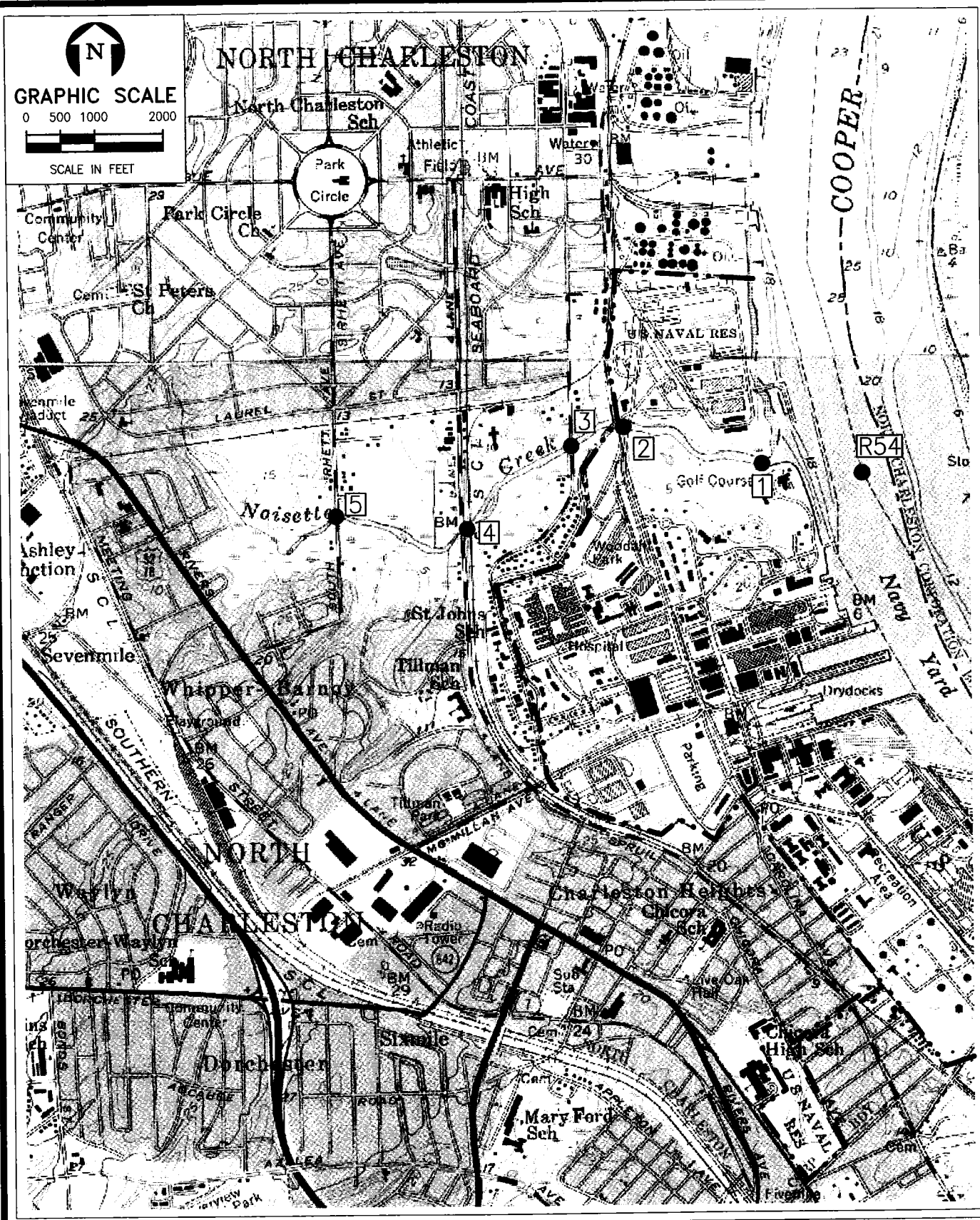

FIGURE 2.

WATER QUALITY SAMPLING STATIONS

Source: USGS Quad: Charleston & North Charleston, SC, 1979; 1979; ECT, 2001.

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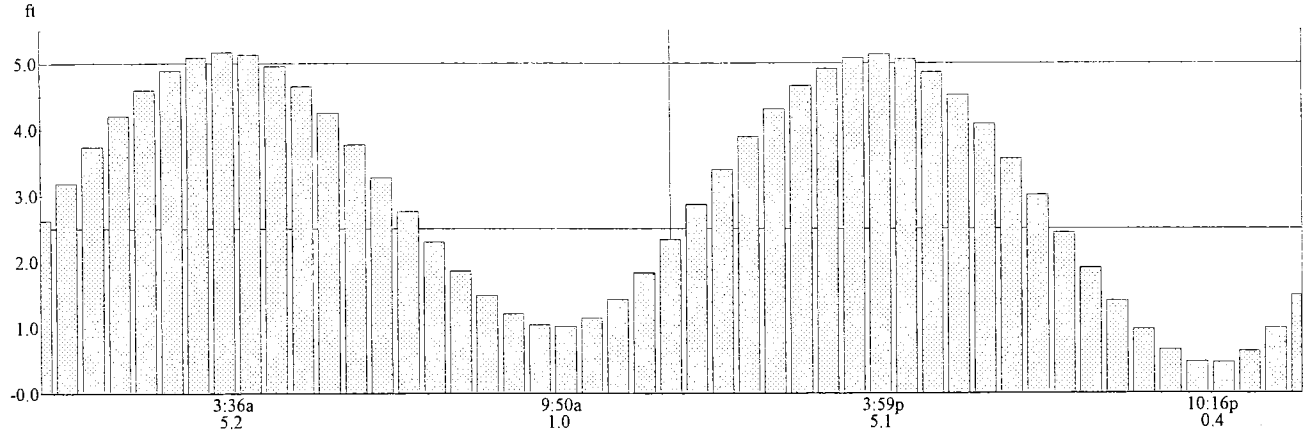
Tides:Cooper River, Clouter Creek, south entrance
based on Charleston (Customhouse Wharf), S.C. (NOAA)
32° 51.60 N 79° 56.30 W

Wednesday, December 6, 2000

Average Tides	
Mean Range:	5.4 ft
MHWS	6.3 ft
Mean Tide:	2.9 ft

Daily Highs & Lows	
3:36a	5.2 ft High
9:50a	1.0 ft Low
3:59p	5.1 ft High
10:16p	0.4 ft Low



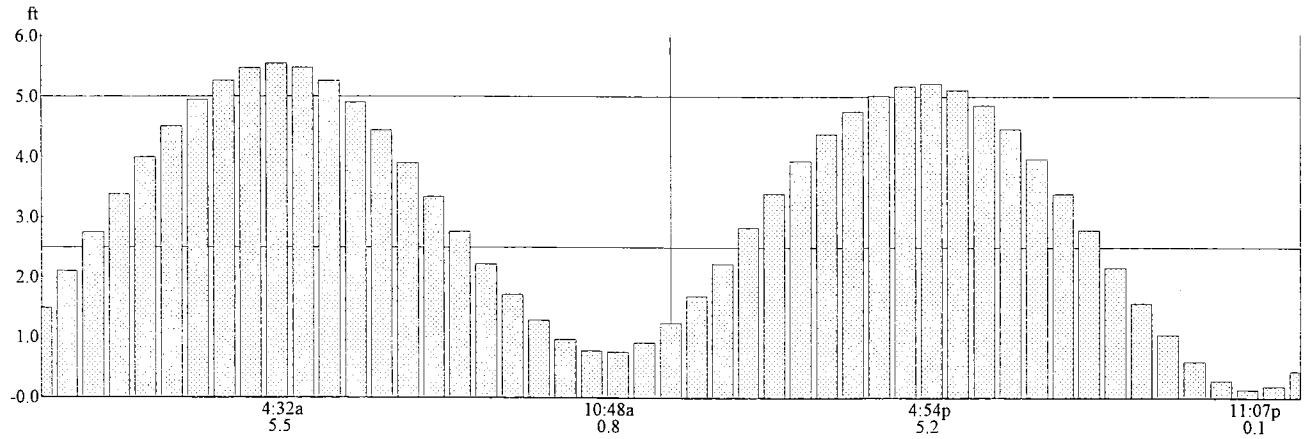
(TZ:+05:00) Time	Tide
12:00a	2.6 ft
12:30a	3.2 ft
1:00a	3.7 ft
1:30a	4.2 ft
2:00a	4.6 ft
2:30a	4.9 ft
3:00a	5.1 ft
3:30a	5.2 ft
4:00a	5.1 ft
4:30a	5.0 ft
5:00a	4.7 ft
5:30a	4.3 ft
6:00a	3.8 ft
6:30a	3.3 ft
7:00a	2.8 ft
7:30a	2.3 ft
8:00a	1.9 ft
8:30a	1.5 ft
9:00a	1.2 ft
9:30a	1.0 ft
10:00a	1.0 ft
10:30a	1.1 ft
11:00a	1.4 ft
11:30a	1.8 ft
12:00p	2.3 ft
12:30p	2.9 ft
1:00p	3.4 ft
1:30p	3.9 ft
2:00p	4.3 ft
2:30p	4.7 ft
3:00p	4.9 ft
3:30p	5.1 ft
4:00p	5.1 ft
4:30p	5.1 ft
5:00p	4.9 ft
5:30p	4.5 ft
6:00p	4.1 ft
6:30p	3.6 ft
7:00p	3.0 ft
7:30p	2.4 ft
8:00p	1.9 ft
8:30p	1.4 ft
9:00p	1.0 ft
9:30p	0.7 ft
10:00p	0.5 ft
10:30p	0.5 ft
11:00p	0.6 ft
11:30p	1.0 ft
12:00a	1.5 ft

Tides:Cooper River, Clouter Creek, south entrance
based on Charleston (Customhouse Wharf), S.C. (NOAA)
32° 51.60 N 79° 56.30 W

Thursday, December 7, 2000

Average Tides	
Mean Range:	5.4 ft
MHWS	6.3 ft
Mean Tide:	2.9 ft

Daily Highs & Lows	
4:32a	5.5 ft High
10:48a	0.8 ft Low
4:54p	5.2 ft High
11:07p	0.1 ft Low



(TZ:+05:00) Time	Tide
12:00a	1.5 ft
12:30a	2.1 ft
1:00a	2.7 ft
1:30a	3.4 ft
2:00a	4.0 ft
2:30a	4.5 ft
3:00a	4.9 ft
3:30a	5.3 ft
4:00a	5.5 ft
4:30a	5.5 ft
5:00a	5.5 ft
5:30a	5.3 ft
6:00a	4.9 ft
6:30a	4.4 ft
7:00a	3.9 ft
7:30a	3.3 ft
8:00a	2.8 ft
8:30a	2.2 ft
9:00a	1.7 ft
9:30a	1.3 ft
10:00a	1.0 ft
10:30a	0.8 ft
11:00a	0.8 ft
11:30a	0.9 ft
12:00p	1.2 ft
12:30p	1.7 ft
1:00p	2.2 ft
1:30p	2.8 ft
2:00p	3.4 ft
2:30p	3.9 ft
3:00p	4.4 ft
3:30p	4.8 ft
4:00p	5.0 ft
4:30p	5.2 ft
5:00p	5.2 ft
5:30p	5.1 ft
6:00p	4.9 ft
6:30p	4.5 ft
7:00p	4.0 ft
7:30p	3.4 ft
8:00p	2.8 ft
8:30p	2.2 ft
9:00p	1.6 ft
9:30p	1.1 ft
10:00p	0.6 ft
10:30p	0.3 ft
11:00p	0.1 ft
11:30p	0.2 ft
12:00a	0.4 ft

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FIGURE 3.

TIDAL PREDICTION AT COOPER RIVER NEAR CLOUTER CREEK, SOUTH ENTRANCE (DECMEBER 6 TO 7, 2000)

Source: Nobeltec, 2001.

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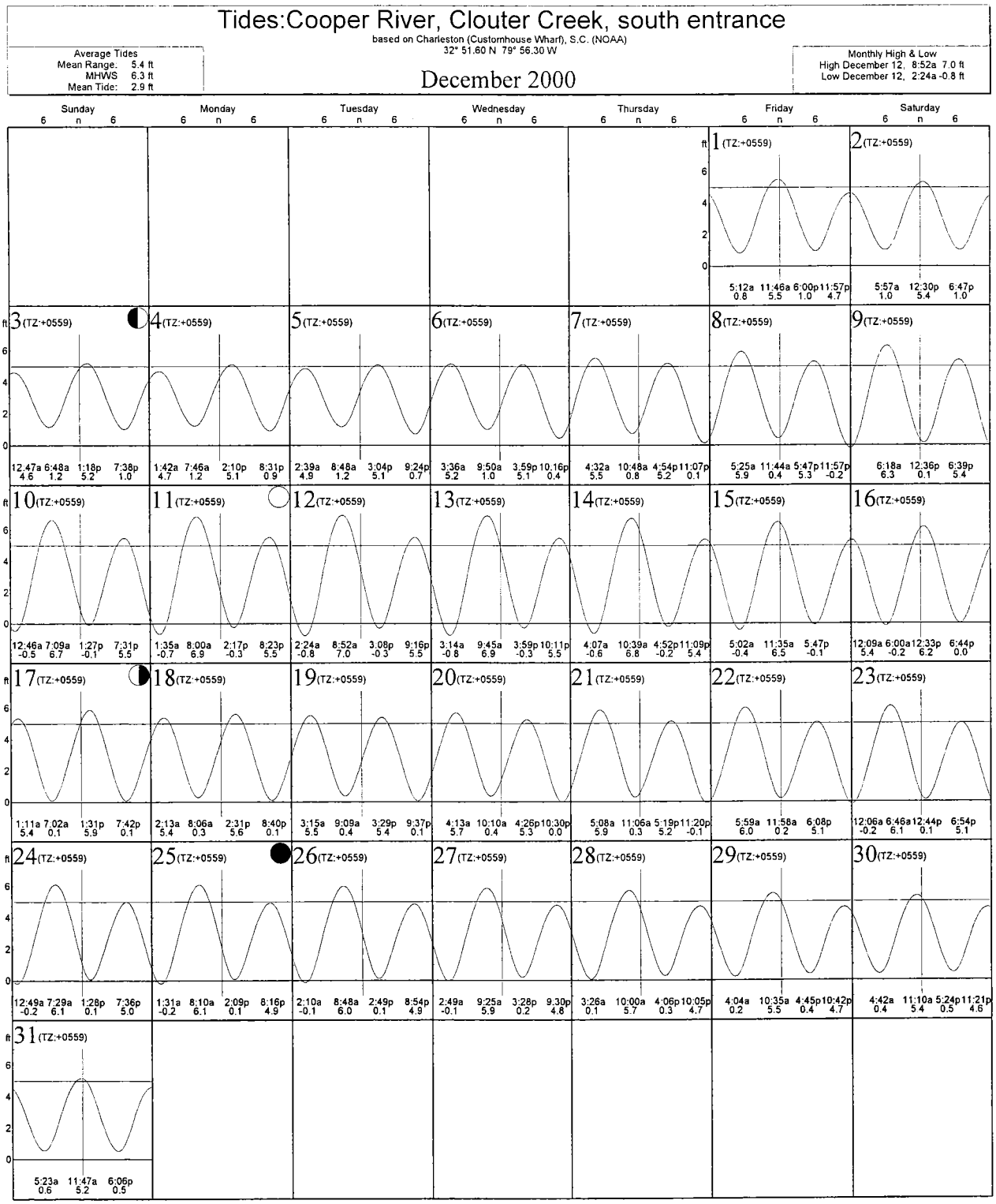

FIGURE 4.

TIDAL PREDICTION AT COOPER RIVER NEAR CLOUTER CREEK, SOUTH ENTRANCE (DECMEBER 1 TO 31, 2000)

Source: Nobeltec, 2001.

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3.1 WATER QUALITY DATA

Water quality data were collected during morning low tide and afternoon high tide on December 6, 2000, and during morning low tide on December 7, 2000. It was found that vertical stratification in the Noisette Creek was insignificant. The difference in surface and bottom salinity was mostly less than 0.5 parts per thousand (ppt) except at Station 1, where a salinity difference of 1.7 ppt was observed. The average values of temperature, conductivity, salinity, DO, and pH at each station at low tide and at high tide are summarized in Table 1.

At low tide, the average salinity ranged from 9.8 ppt at Station 5 to 14.3 ppt at Station 1. At high tide, the average salinity ranged from 13.5 ppt at Station 4 and to 15.9 ppt at Station 1. DO concentration was generally lower at low tide compared to high tide values because the sediment oxygen demand might have consumed a significant amount of oxygen during low tide when water stayed in the creek for about half of a tidal cycle. In contrast, high DO water at Cooper River flows into Noisette Creek during flood tide, replenishing DO in the creek. The lowest observed DO was 4.93 milligrams per liter (mg/L) at Station 5 during morning low tide on December 7, 2000, with a 43.8 percent DO saturation level.

The lowest DO concentration normally occurs during early morning low tide because the respiration through the night further depleted oxygen in addition to the effects of sediment oxygen demand. Higher DO concentrations, ranging from 8.84 to 9.34 mg/L (89.7 to 93.4 percent saturation) were observed throughout the creek during afternoon high tide. The afternoon DO in the creek was higher than DO in the Cooper River, probably due to the photosynthesis effects of the marsh.

Low pH values were observed during morning low tide at upstream stations. The lowest value of 5.39 was measured at Station 5 in the morning on December 6, 2000. There were not sufficient data to determine whether the cause of low pH values was from upland sources or the bio-activity in the marsh. The complete water quality data are shown in Table 2.

Table 1. Noisette Creek Water Quality Data Summary (December 6 to 7, 2000)

Station	Temperature (°C)	Conductivity	Salinity (ppt)	D.O. (mg/L)	D.O. Saturation (%)	pH
Low Tide Average						
1	11.06	23,578	14.29	8.66	86.42	7.33
2	8.66	21,224	12.69	6.27	58.24	6.49
3	8.04	20,023	11.88	5.97	56.90	6.19
4	8.09	18,810	11.11	5.70	51.50	5.94
5	7.44	16,715	9.77	5.60	43.80	5.58
R54	11.92	28,795	17.71	8.62	89.25	7.79
High Tide Average						
1	11.94	25,960	15.86	8.86	90.73	7.92
2	11.94	24,987	15.23	8.95	91.30	7.89
3	12.06	22,845	13.81	9.16	92.95	7.86
4	11.77	22,335	13.48	9.28	93.55	7.78
5	11.54	22,520	13.59	8.98	89.85	7.81
R54	11.86	35,612	22.44	8.05	85.32	7.90

Source: ECT, 2001.

Table 2. In-Situ Water Quality Data at Noisette Creek (December 6 to 7, 2000)

Station	Date	Time	Water Depth (meters)	Sampling Depth (meters)	Temperature (°C)	Conductivity (µmho/cm)	Salinity (ppt)	D.O. (mg/l)	D.O. Saturation (%)	pH
5	12/6/00	9:02	< 0.3	0.15		16,250	9.45	6.27		5.39
4	12/6/00	9:20	<0.3	0.15		18,490	10.88	6.15		6.06
3	12/6/00	9:30	0.8	0.15	7.65	20,310	12.07	5.73		6.55
3	12/6/00			0.70	7.77	20,520	12.21	5.38	48.9	6.60
2	12/6/00	9:53	1.5	0.15	8.17	20,780	12.39	6.31	56.6	6.81
2	12/6/00			0.80	8.36	21,130	12.62	5.93	54.7	6.89
2	12/6/00			1.30	8.5	21,240	12.70	5.92	54.9	6.91
1	12/6/00	10:52	1.2	0.15	11.71	22,620	13.66	9.17	92.6	7.54
1	12/6/00			1.04	11.73	22,630	13.66	9.10	91.5	7.62
R54	12/6/00	11:05		0.15	11.86	22,140	13.34	8.86	89.2	7.93
R54	12/6/00			1.74	11.98	24,250	14.67	8.72	88.6	7.94
R54	12/6/00			4.03	12.18	26,180	16.02	8.63	88.9	7.94
R54	12/6/00			6.60	12.21	29,300	18.09	8.52	89.1	7.92
R54	12/6/00			9.18	12.12	37,380	23.58	8.32	89.8	7.87
R54	12/6/00			11.26	12.09	40,020	25.49	8.25	90.1	7.81
4	12/6/00	15:00	1.3	0.45	11.83	22,330	13.48	9.22	92.8	7.80
4	12/6/00			1.05	11.7	22,340	13.48	9.34	94.3	7.76
5	12/6/00	15:10		0.59	11.53	22,510	13.59	8.96	89.7	7.81
5	12/6/00			1.32	11.55	22,530	13.59	8.99	90.0	7.81
3	12/6/00	15:23		0.86	12.06	22,780	13.76	9.15	92.5	7.91
3	12/6/00			1.48	12.05	22,910	13.86	9.17	93.4	7.81
2	12/6/00	16:04		0.49	11.96	24,620	14.98	8.97	91.4	7.92
2	12/6/00			1.48	11.95	25,020	15.27	8.95	91.3	7.91
2	12/6/00			2.55	11.92	25,320	15.45	8.93	91.2	7.85
1	12/6/00	16:27		0.17	11.97	24,800	15.08	8.94	91.1	7.94
1	12/6/00			1.25	11.95	25,720	15.70	8.84	90.4	7.92
1	12/6/00			2.53	11.9	27,360	16.81	8.80	90.7	7.91
R54	12/6/00	16:34		0.53	11.96	28,330	17.45	8.86	91.7	7.98
R54	12/6/00			1.98	12.03	29,650	18.33	8.81	91.7	7.99
R54	12/6/00			4.83	11.79	38,560	24.48	8.41	90.4	7.91
R54	12/6/00			8.49	11.76	40,880	26.11	7.72	82.8	7.85
R54	12/6/00			10.72	11.76	40,640	25.83	6.45	70.0	7.78
5	12/7/00	9:07	0.3	0.15	7.44	17,180	10.08	4.93	43.8	5.77
4	12/7/00	9:31	0.3	0.15	8.09	19,130	11.33	5.25	51.5	5.81
3	12/7/00	9:45		0.15	8.71	19,240	11.36	6.80	64.9	5.43

Table 2. In-Situ Water Quality Data at Noisette Creek (December 6 to 7, 2000)

Station	Date	Time	Water Depth (meters)	Sampling Depth (meters)	Temperature (°C)	Conductivity (µmho/cm)	Salinity (ppt)	D.O. (mg/l)	D.O. Saturation (%)	pH
2	12/7/00	10:39		0.26	9.09	21,130	12.64	6.37	60.1	6.03
				1.15	9.17	21,840	13.11	6.82	64.9	5.81
1	12/7/00	10:56		0.09	10.25	23,240	14.04	7.87	77.1	7.19
1	12/7/00			0.50	10.68	24,260	14.72	8.43	83.6	7.19
				1.07	10.95	25,140	15.36	8.73	87.3	7.12
R54	12/7/00	11:04		0.13	11.78	25,520	15.59	8.75	89.2	7.73
R54	12/7/00			1.17	11.76	25,800	15.78	8.74	89.1	7.72
R54	12/7/00			3.85	11.72	26,910	16.43	8.70	89.0	7.69
R54	12/7/00			5.93	11.7	28,100	17.28	8.63	88.6	7.64
R54	12/7/00			7.03	11.72	31,150	18.50	8.70	90.1	7.52
2	12/7/00	11:24		0.61	9.67	22,030	13.26	6.86	65.4	7.04
2	12/7/00	11:30		0.61	9.58	22,120	13.29	6.78	64.8	7.09
2	12/7/00	11:46		0.61	9.72	22,130	13.30	6.79	65.4	7.14

Source: ECT, 2001.

3.2 CURRENTS

Tidal current velocities were measured on December 6 between 12:00 to 1:30 p.m. at five monitoring stations in Noisette Creek during peak flood current. The current velocities were also measured during peak ebb current in the afternoon on December 6, 2000, and during peak flood current in the afternoon on December 7, 2000. The following table shows the peak profile-averaged current speeds at each station during flood tide and ebb tide.

	Peak Current Speed	
Station	Flood (m/sec)	Ebb (m/sec)
1	0.25	0.25
2	0.15	0.30
3	0.15	0.20
4	0.22	0.34
5	0.18	0.09

The maximum profile-averaged ebb current of 0.34 meters per second (m/sec) was recorded at Station 4, and the maximum profile-averaged flood current of 0.25 m/sec was recorded at Station 1. The maximum surface current speed of 0.29 m/sec during flood tide was recorded at Station 1, and the maximum surface current speed of 0.34 m/sec was recorded at Station 4 during ebb tide.

Table 3 shows the current speed data in Noisette Creek. As previously described, the current data was measured close to the neap tide; therefore, the long-term average peak current in the creek could be 15 percent to 32 percent higher than the values measured during the study. The calculation was based on the ratio of the tide ranges.

3.3 SEDIMENTS

A petite ponar was used to collect bottom sediment samples in Noisette Creek for visual examination. The soil classification of the sediment samples are presented as follows:

Table 3. Noisette Creek Current Data (December 6 to 7, 2000)

Station	Date	Time	Depth (meters)	Current Speed (m/sec)
1	12/6/00	12:08	1.83	0.16
1	12/6/00	12:11	1.22	0.16
1	12/6/00	12:12	0.61	0.14
1	12/6/00	12:13	0.15	0.13
2	12/6/00	12:22	0.30	0.17
2	12/6/00	12:23	0.91	0.14
2	12/6/00	12:24	1.52	0.13
4	12/6/00	12:56	0.61	0.17
3	12/6/00	13:11	0.61	0.13
3	12/6/00	13.12	1.22	0.15
5	12/6/00	13:24	0.61	0.12
1	12/6/00	17:05	0.46	0.20
1	12/6/00	17:10	0.61	0.23
1	12/6/00	17:11	0.61	0.24
1	12/6/00	17:18	0.61	0.21
1	12/6/00	17:24	0.61	0.23
1	12/6/00	17:27	0.61	0.26
1	12/6/00	17:30	0.61	0.26
1	12/6/00	17:33	0.61	0.27
1	12/6/00	17:34	1.22	0.23
1	12/6/00	17:36	0.61	0.25
5	12/6/00	18:15	0.91	0.09
4	12/6/00	18:22	0.61	0.34
3	12/6/00	18:30	0.61	0.23
3	12/6/00	18:33	1.22	0.17
2	12/6/00	18:45	0.61	0.30
2	12/6/00	18:47	1.22	0.30
1	12/7/00	13:04	0.61	0.21
1	12/7/00	13:05	0.30	0.24
1	12/7/00	13:06	1.22	0.20
1	12/7/00	13:09	0.61	0.20
1	12/7/00	13:12	0.61	0.24
1	12/7/00	13:13	0.61	0.26

Table 3. Noisette Creek Current Data (December 6 to 7, 2000)

Station	Date	Time	Depth (meters)	Current Speed (m/sec)
1	12/7/00	13:16	0.61	0.24
1	12/7/00	13:18	0.61	0.27
1	12/7/00	13:20	0.61	0.21
1	12/7/00	13:21	0.30	0.29
1	12/7/00	13:22	0.61	0.27
1	12/7/00	13:23	0.91	0.20
2	12/7/00	13:34	0.30	0.12
2	12/7/00	13:36	0.61	0.15
2	12/7/00	13:37	0.91	0.14
3	12/7/00	14:10	0.61	0.16
3	12/7/00	14:12	1.22	0.09
3	12/7/00	14:13	0.30	0.19
4	12/7/00	14:21	0.61	0.22
4	12/7/00	14:23	0.30	0.22
5	12/7/00	14:30	0.61	0.14
5	12/7/00	14:35	0.61	0.17
5	12/7/00	14:38	0.61	0.18
5	12/7/00	14:42	0.61	0.17

Source: ECT, 2001.

- Station 1—Very dark gray clayey sand, saturated. Approximately 30 to 40 percent clay, fine to very fine-grained sand; approximately 10 percent decaying organic matter (leaves, etc); decaying vegetation odor.
- Station 2—Dark gray clayey sand, saturated. Approximately 20 percent clay, fine to very fine-grained sand; approximately 10 to 20 percent decaying organic matter (leaves, etc) and shells up to approximately ½-inch diameter; decaying vegetation odor.
- Station 3—Decaying organic matter (leaves, twigs, etc) and shells (up to ¾-inch diameter) in dark olive gray clayey matrix. Mostly organic matter and shells; decaying vegetation odor.
- Station 4—Very dark clayey sand. Approximately 30 to 40 percent clay, approximately 10 to 20 percent decaying organic matter, minor shells, fine to very fine sand, and saturated; strong decaying vegetation odor.
- Station 5—Very dark gray clayey sand, saturated, very fine-grained sand. Approximately 45 percent clay, very minor organic debris (<5 percent), very strong sulfer, decaying vegetation odor.

The sediment matrix is mostly fine to very fine sand throughout the Noisette Creek bottom except for Station 3, where abundant inactive oyster shells were found. These shell materials might be the remnants of the deployed oysters and clams for a previous bioaccumulation study. The finest materials were observed in Station 5, the upstream location. There were increasing decaying organic material from Station 1 (the creek mouth) to Station 5. The spatial trend of organic material distribution supports the hypothesis that low oxygen concentration in upstream reach of the creek during low tides is caused by high sediment oxygen demand in the marsh area. The distribution of the grain size of the sand particles suggests that the major source of the sandy materials is the upland urban areas between Station 1 and Station 4.

Highest clay contents were found at both Station 1 and Station 5, which suggests that there are dual sources of the clay materials. One source is the upland runoff, mostly from

the urban area outside of CNC, another source is the Cooper River, which brings suspended fine materials, or clays, into Noisette Creek during flood tides. The tidal velocity in Noisette Creek is much smaller than in the Cooper River; therefore, the fine materials start to settle in the creek when it enters the creek.

3.4 TIDAL FLUSHING

As stated in Section 2.0, the tidal prism in Noisette Creek is about 384 acre-ft. The volume of water in the creek at low tide is estimated to be 46 acre-ft; therefore, about 90 percent of the water in the creek can be flushed out of the system within one tidal cycle. The flushing time will be longer at the upstream end of the creek than near the mouth.